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First Named Inventor:	OUDERKIRK, ANDREW J.		
Application No.:	10/762678	Group Art Unit:	2814
Filed:	January 20, 2004	Examiner:	Louie, Wai Sing
Title:	PHOSPHOR BASED LIGHT SOURCES HAVING FRONT ILLUMINATION		

BRIEF ON APPEAL

Mail Stop: Appeal Brief-Patents
Commissioner for Patents
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Alexandria, VA 22313-1450

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24 Mar 2006
Date

Stephen C. Jensen
Signed by: Stephen C. Jensen

Dear Sir:

This is an appeal from the Office Action dated 10/14/2005, which finally rejected all pending claims 1-21.

A Notice of Appeal was mailed January 13, 2006 with a certificate of mailing, and was received at the USPTO on January 24, 2006. This brief is therefore believed to be timely submitted.

The fee required under 37 CFR § 41.20(b)(2) for filing an appeal brief should be charged to Deposit Account No. 13-3723.

Appellants request the opportunity for a personal appearance before the Board of Appeals to argue the issues of this appeal. The fee for the personal appearance will be timely paid upon receipt of the Examiner's Answer.

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REAL PARTY IN INTEREST

The real party in interest is 3M Company (formerly known as Minnesota Mining and Manufacturing Company) of St. Paul, Minnesota and its affiliate 3M Innovative Properties Company of St. Paul, Minnesota.

RELATED APPEALS AND INTERFERENCES

Appellants are unaware of any related appeals or interferences.

STATUS OF CLAIMS

Claims 1-21 are pending. All of these claims stand rejected, and all are being appealed.

STATUS OF AMENDMENTS

No amendments have been filed after the final Office Action of 10/14/2005.

SUMMARY OF CLAIMED SUBJECT MATTER

Claim 1

The subject matter of independent claim 1 is a light source that includes an LED capable of emitting light, a layer of phosphor material, and interference reflector means. The layer of phosphor material is positioned to receive excitation light from the LED, and it emits visible light when illuminated with the excitation light. The interference reflector means performs two functions: (1) it reflects at least some light emitted by the LED that has not passed through the layer of phosphor material, onto the layer of phosphor material, and (2) it transmits at least some visible light emitted by the phosphor.

Support for the various elements of claim 1 can be found throughout the specification and drawings. An "LED capable of emitting light" is described for example at page 2 lines 5-8, page 3 lines 4-19, page 15 lines 13-17, and is shown in FIGS. 1 and 5-12 (element 12), FIG. 13 (element 212), FIG. 14 (element 312), and FIG. 15 (element 412). A layer of phosphor material is shown in at least FIGS. 1, 2 (element 22), 5 (element 42), 6 and 7 (element 52), 8 (element 72), 9 (element 82), 10 (element 92), 11 (element 102), 13 (element 222), 14 (element 322), and 15 (element 422), and described in various places such as p. 3 lines 14-26, p. 9 lines 21-26, p. 13 lines 6-13, p. 14 line 22 to p. 15 line 10, and p. 19 line 21 to p. 21 line 11. With regard to the

interference reflector means for performing the two functions mentioned above, the structure for performing those functions and the functions themselves are shown and described in various places, including: page 3 lines 16-18 (mentioning the reflector's ability to reflect UV excitation light (emitted by the LED) and transmit visible light (emitted by the phosphor)), page 3 line 27 to p. 4 line 5, p. 4 line 17 to p. 5 line 2, p. 7 line 11 to p. 10 line 20, and p. 16 line 8 to p. 18 line 2 (using the term "interference reflector" and describing reflector constructions that can selectively reflect the LED excitation light and transmit the phosphor-emitted light). Arrangements in which the interference reflector means is performing both functions, including specifically reflecting onto the layer of phosphor material at least some light emitted by the LED *that has not passed through the layer of phosphor material*, are shown and described in connection with FIGS. 9, 10, 13, and 15. The embodiment of FIG. 9, discussed further below, depicts a reflector 86 reflecting onto a layer of phosphor material 82 light emitted by an LED 12 that has not passed through the layer of phosphor material. The specification teaches at p. 13 lines 3-5 that the reflector 86 also transmits light emitted by the phosphor layer.

Claim 2

The subject matter of independent claim 2 is a light source that includes a layer of phosphor material, an LED capable of emitting light that excites the phosphor material, and an interference reflector. The interference reflector is positioned to reflect at least some light emitted by the LED that has not passed through the layer of phosphor material, onto the layer of phosphor material.

As with claim 1, support for the various elements of claim 2 can be found throughout the specification and drawings. An "LED capable of emitting light that excites the phosphor material" is described for example at page 2 lines 5-8, page 3 lines 4-19, page 15 lines 13-17, and is shown in FIGS. 1 and 5-12 (element 12), in FIG. 13 (element 212), in FIG. 14 (element 312), and in FIG. 15 (element 412). A layer of phosphor material is shown in at least FIGS. 1, 2 (element 22), 5 (element 42), 6 and 7 (element 52), 8 (element 72), 9 (element 82), 10 (element 92), 11 (element 102), 13 (element 222), 14 (element 322), and 15 (element 422), and described in various places such as p. 3 lines 14-26, p. 9 lines 21-26, p. 13 lines 6-13, p. 14 line 22 to p. 15 line 10, and p. 19 line 21 to p. 21 line 11. Interference reflectors are shown and described in various places, including: page 3 lines 16-18, page 3 line 27 to p. 4 line 5, p. 4 line 17 to p. 5 line 2, p. 7 line 11 to p. 10 line 20, and p. 16 line 8 to p. 18 line 2 (using the term "interference

reflector" and describing reflector constructions that can selectively reflect the LED excitation light and transmit the phosphor-emitted light). Arrangements in which the interference reflector is positioned to reflect at least some light emitted by the LED *that has not passed through the layer of phosphor material* onto the layer of phosphor material, are shown and described in connection with FIGS. 9, 10, 13, and 15.

The language in claims 1 and 2 referring to reflecting onto the layer of phosphor material at least some light emitted by the LED "that has not passed through the layer of phosphor material" is closely related to disclosed light source embodiments that use a front or top surface illumination technique. In this technique, an interference reflector is used to directly illuminate the layer of phosphor material (at least partially) from the front or top, rather than solely from the back or bottom of the phosphor layer. This can be understood by comparing the light source of Appellants' FIGS. 1-2 with that of FIGS. 9, 10, 13, and 15.

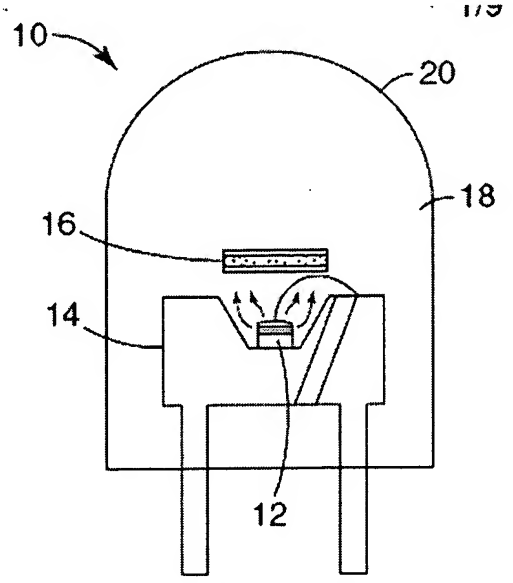


FIG. 1

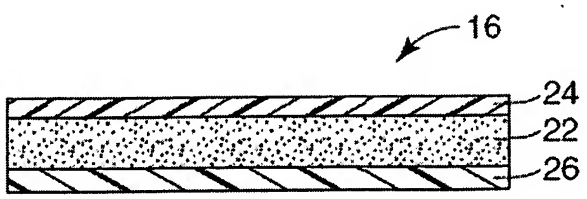


FIG. 2

In FIGS 1-2, long-pass reflector 24 (an interference reflector) reflects light from the LED light source onto the phosphor layer 22, but it only reflects LED light that has already passed through the phosphor layer. Thus, direct illumination from the LED is exclusively from the back or bottom surface of the phosphor layer (through short-pass reflector 26).

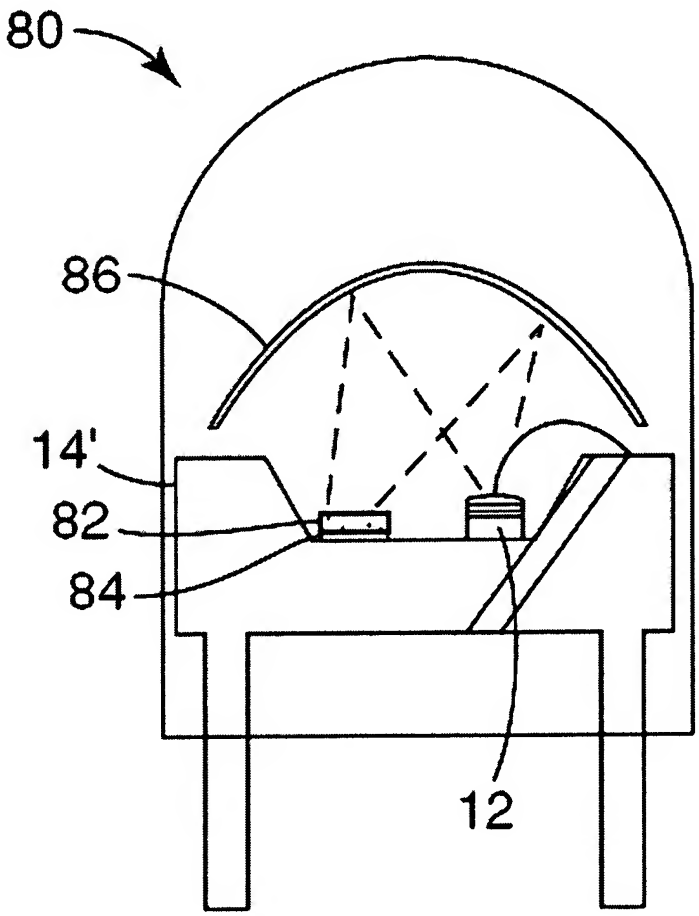


FIG. 9

In contrast, long-pass filter 86 of FIG. 9 (also an interference reflector) is positioned to receive light from the LED that has not passed through the phosphor layer, and reflect that light directly onto the front or top surface of the phosphor layer 82. Thus, the layer of phosphor material is directly illuminated from the front or top. Such an arrangement is feasible because the interference reflector (such as a long-pass filter) has wavelength selective properties such that it

can not only reflect the LED excitation light, but also transmit the (typically longer wavelength) light emitted by the phosphor layer, so that the light emitted by the phosphor layer is not trapped within the light source. Advantages of the front illumination technique are discussed in the specification at p. 13 lines 6-13.

Claim 3

The subject matter of multiply dependent claim 3 is a light source having the features of either claim 1 or claim 2, and wherein the layer of phosphor has a major surface from which light is emitted toward an output end of the light source, and wherein the light emitted by the LED that has not passed through the layer of phosphor material is reflected onto the major surface of the layer of phosphor material. This additional feature is shown in FIGS. 9, 10, 13, and 15. In FIG. 9, for example, discussed at p. 12 line 21 to p. 13 line 13, the phosphor layer 82 has an upper major surface from which light is emitted toward the rounded front end of the light source body. As explained above, the long-pass filter 86 reflects LED light that has not passed through the layer of phosphor material onto that upper major surface.

Claim 5

The subject matter of dependent claim 5 is a light source having the features of claim 2, and wherein the reflector has a planar shape. Interference reflectors of the type specified in claim 2 and having a planar shape are shown for example in FIGS. 1, 2 (element 24), and 11 (element 106), and discussed e.g. at p. 4 line 27 to p. 5 line 2, p. 24 lines 16-18, p. 25 line 18, and p. 26 line 27.

Claim 7

The subject matter of dependent claim 7 is a light source having the features of claim 2, and wherein the reflector has a non-planar shape (dependent claim 6), and the non-planar shape is substantially an ellipsoid, and wherein the LED and the layer of phosphor material are disposed at foci of the ellipsoid. This arrangement is shown for example in FIG. 9 and described at p. 12 line 21 to p. 13 line 5.

Claim 11

The subject matter of dependent claim 11 is a light source having the features of claim 2, and wherein the layer of phosphor material is segmented into distinct color regions. This feature is shown for example in FIG. 14 (depicting regions 322A-D), and described at p. 26 lines 7-16.

Claim 12

The subject matter of dependent claim 12 is a light source having the features of claim 2, and wherein the layer of phosphor material is co-planar with the LED. This feature is shown for example in FIGS. 9 and 13, and discussed at p. 12 lines 25-27 and p. 24 line 2 to p. 25 line 1.

Claim 14

The subject matter of dependent claim 14 is a light source having the features of claim 2, and wherein the layer of phosphor material is a discontinuous layer of phosphor material. This feature is described for example at p. 19 line 21 to p. 20 line 4, and p. 26 lines 7-16.

Claim 20

The subject matter of dependent claim 20 is a light source having the features of claim 2, and wherein the reflector comprises alternating layers of a first and second thermoplastic polymer wherein at least some of the layers are birefringent. This feature is described for example at p. 4 lines 17-22, and p. 23 line 26 to p. 24 line 15.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-4, 6, 8-10, and 13 have been finally rejected under 35 USC § 102(b) as being anticipated by U.S. Patent 5,959,315 (Lowery).

Claims 5 and 7 have been finally rejected under 35 USC § 103(a) as being unpatentable over U.S. Patent 5,959,316 (Lowery) in view of U.S. Patent 5,982,092 (Chen).

Claims 11-12, 14-19, and 21 have been finally rejected under 35 USC § 103(a) as being unpatentable over U.S. Patent 5,959,316 (Lowery) in view of U.S. Patent 6,717,348 (Takahashi).

Claim 20 has been finally rejected under 35 USC § 103(a) as being unpatentable over U.S. Patent 5,959,316 (Lowery) in view of U.S. Patent 6,652,996 (Steklenski et al.).

The issues presented for review are:

1. whether claims 1-4, 6, 8-10, and 13 are novel over Lowery;
2. whether claims 5 and 7 are patentably nonobvious over Lowery in view of Chen;
3. whether claims 11-12, 14-19, and 21 are patentably nonobvious over Lowery in view of Takahashi; and
4. whether claim 20 is patentably nonobvious over Lowery in view of Steklenski.

ARGUMENT

1. Claims 1-4, 6, 8-10, and 13 are novel over Lowery

Claim 1

In order to anticipate a claim, a reference must teach every element of the claim. Claim 1 recites a light source that includes, among other things, interference reflector means for reflecting a first light component ("at least some light emitted by the LED that has not passed through the layer of phosphor material") onto the layer of phosphor material and transmitting a second light component ("at least some visible light emitted by the phosphor"). Lowery teaches nothing like this. The Examiner cites element 16 and FIG. 3 of Lowery:

FIG. 2
(PRIOR ART)

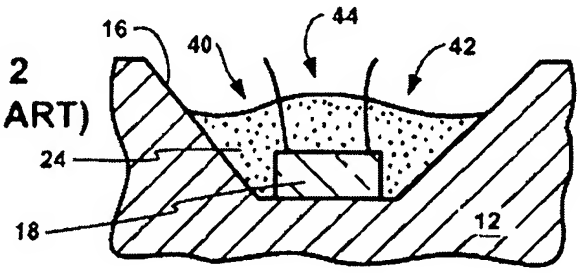
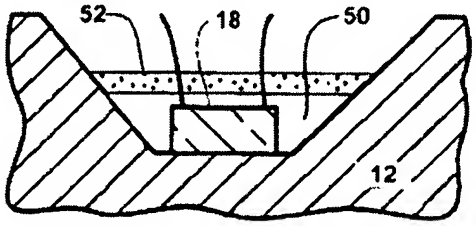


FIG. 3



Element 16, however, is nothing more than a recessed reflective portion of a conventional lead frame 12. See Lowery at, for example, col. 2 lines 4-30. Even if Lowery's reflector 16 reflects light emitted by the LED that has not passed through the layer of phosphor material 52 onto the layer of phosphor material, nothing in Lowery indicates that that reflector also "transmit[s] at least some visible light emitted by the phosphor" as set forth in Appellants' claim 1. Since Lowery fails to teach the interference reflector means recited in claim 1, which requires both a reflecting and transmitting function, it cannot anticipate that claim and the rejection should be reversed.

Claims 2, 4, 6, 8-10, and 13

Claim 2 recites a light source that includes, among other things, "an interference reflector positioned to reflect at least some light emitted by the LED that has not passed through the layer of phosphor material, onto the layer of phosphor material." As mentioned above, Lowery's reflector 16 is nothing more than a recessed reflective portion of a conventional lead frame 12. Nowhere does Lowery teach using an interference reflector in his light source, much less one that is positioned as described in the claim. Since Lowery fails to teach the interference reflector of claim 2, it cannot anticipate that claim, nor any claim that includes all the limitations of claim 2, including claims 4, 6, 8-10, and 13. The rejection of those claims should be reversed.

Claim 3

Claim 3 is multiply dependent from either claim 1 or claim 2, and further recites the layer of phosphor has a major surface from which light is emitted toward an output end of the light source, and wherein the light emitted by the LED that has not passed through the layer of phosphor material is reflected onto the major surface of the layer of phosphor material. Even if one overlooks the absence of an interference reflector or interference reflector means in Lowery, this additional feature is not only absent but it is opposite to the approach of Lowery. In FIG. 3 of Lowery, the reflector (the recessed portion of the lead frame) reflects onto the layer of phosphor material 52 light from the LED that has not passed through such layer, but it reflects that light onto the *bottom* major surface of the layer (the surface from which light is emitted *away from* the output end of Lowery's light source), not onto the *top* major surface (from which light is emitted *toward* the output end of Lowery's light source). Since Lowery fails to teach any light source having the additional features recited in Appellants' claim 3, it cannot anticipate claim 3. The rejection of claim 3 should be reversed.

2. Claims 5 and 7 are patentably nonobvious over Lowery in view of Chen

Claim 5

Claim 5 depends directly from claim 2 and further specifies that the interference reflector has a planar shape. U.S. Patent 5,982,092 (Chen) discusses "LED planar light sources" that include a reflection layer (element 30 shown in FIGS. 3-6 of Chen) and a fluorescent pigment layer (element 50 in FIGS. 3-6 of Chen). But just as with Lowery, Chen lacks any teaching that the reflector is an interference reflector. Since neither reference teaches any type of interference

reflector, much less a planar one as set forth in claim 5, the combination of Lowery with Chen cannot render claim 5 obvious. The rejection of claim 5 should be reversed.

Claim 7

Claim 7 includes all the features of claim 2 and further specifies that the reflector has a non-planar shape that is substantially an ellipsoid, and wherein the LED and the layer of phosphor material are disposed at foci of the ellipsoid. An example of this is shown and described in connection with Appellants' FIG. 9. The ellipsoidal shape of the reflector, and the placement of the LED and the layer of phosphor material at the foci of the ellipsoid, promotes system efficiency by ensuring that as much of the LED light as possible is reflected onto the layer of phosphor material.

The Examiner acknowledged in the final rejection that Lowery does not teach an ellipsoidal reflector, and Applicants note that neither does Chen. Nevertheless, the Examiner rejected the claim using the following logic: (i) Lowery discloses a hemispherically-shaped phosphor layer 66 (FIG. 4); (ii) changes in product shape are obvious, citing *In re Daily* [sic: *In re Dailey and Eilers*], 149 USPQ 47 (CCPA 1966) and *Glue Co. v. Upton*, 97 US 3 (1878); (iii) it therefore would have been obvious to modify Lowery's hemispherical phosphor layer to an ellipsoidal shape; and (iv) it therefore would have been obvious to modify the reflector to also be ellipsoidal. This argument fails for a number of reasons.

First, the cases cited by the Examiner in item (ii) above do not by any means stand for the broad proposition that every modification of the shape of a known product or a component thereof is *per se* unpatentably obvious. *Glue Co.* dealt with glue material, where the prior art disclosed a glue composition in the form of hard, angular flakes, and the alleged invention was directed to glue material of the same composition but in pulverized form. *Glue Co. v. Upton*, 97 US 3, 4. The Supreme Court held that such a change in form was insufficient for patentability. *Id* at 6. *In re Dailey and Eilers* dealt with a disposable infant nursing container having a collapsible portion, where the prior art disclosed a container similar to the claim but where the shape of the top and bottom sections was not "a portion of a sphere less than a hemisphere" as in the proposed claim. *In re Dailey and Eilers*, 149 USPQ 47, 48-49. The Court of Customs and Patent Appeals held that the difference in configuration was unpatentably obvious. *Id* at 50. These cases dealt with issues pertaining to specific types of articles, and cannot be read to stand for the proposition that any modification in shape of a known device or component thereof is

patentably obvious. In contrast to glue particles or baby bottles, in the field of optics even subtle changes in the shape of a reflector can have major effects on its functionality. This is particularly true with respect to claim 7, because a planar reflector does not have any focusing properties, but a non-planar ellipsoidal reflector does. Placing the LED and phosphor layer at the foci as recited by the claim exploits the ellipsoidal shape in a way that is not possible with a planar reflector.

Second, item (iv) in the Examiner's argument does not follow from the other steps in the argument. Even assuming *arguendo* that it would have been obvious to modify the shape of Lowery's fluorescent material layer 66 from hemispherical to ellipsoidal, that provides no justification for changing the shape of the reflector to also be ellipsoidal. After all, in Lowery's embodiment (FIG. 4) where the fluorescent material layer 66 is hemispherical, the surface of the device substrate 62 is *planar* – not hemispherical. Nowhere does Lowery teach or suggest that the reflector should have the same shape as the fluorescent material layer. It would not have been obvious to modify the shape of Lowery's reflector to be ellipsoidal.

Third, even if Lowery included a suggestion to make the reflector ellipsoidal, there would still be no teaching or suggestion to place the LED and the phosphor layer at the foci of the ellipsoid. This feature of claim 7 was not addressed at all in the final Office Action.

Finally, the non-planar reflector set forth in claim 7 is the interference reflector of claim 2, and as explained above no interference reflector is taught or suggested in either Lowery or Chen.

In summary, nothing in either Lowery or Chen, or in any proper combination thereof, teaches or suggests a light source including an ellipsoidally-shaped interference reflector, nor that the LED and the layer of phosphor material are placed at the foci of the ellipsoid. The rejection of claim 7 should be reversed.

3. Claims 11-12, 14-19, and 21 are patentably nonobvious over Lowery in view of Takahashi

Claim 11

Claim 11 depends directly from claim 2 and further specifies that the layer of phosphor material is segmented into distinct color regions. The final Office Action reasoned that Lowery and Takahashi "have substantially the same environment of a LED having a phosphor layer to convert the wavelength of the emitted light", and it therefore would have been obvious "to

modify Lowery's device with the teaching of Takahashi to provide the phosphor dots in order to form a full-color display." Appellants acknowledge that Takahashi discusses an LED light source (col. 4 lines 15-17), and a phosphor layer 80 that includes red, green, and blue phosphor dots 81, 82, 83 (col. 5 lines 16-59). Takahashi also discusses wavelength-selective optical filters (col. 5 lines 16-26) and Fabry-Perot interference (col. 12 lines 16-42). However, Takahashi and Lowery are directed to substantially different end-products: Lowery to a discrete semiconductor LED device (see col. 1 lines 1-8 of Lowery, and the figures), and Takahashi to an entire display apparatus (see col. 1 lines 1-11 of Takahashi, and the figures), of which an LED light source would be a small component. The phosphor dots 81, 82, 83 of Takahashi are discussed specifically in connection with "a color display apparatus", see col. 5 lines 27-28. One of ordinary skill in the art therefore would have no motivation or incentive to transfer these display-related features of Takahashi into the discrete LED devices of Lowery.

Claim 11 also of course includes the limitation of claim 2 of "an interference reflector positioned to reflect at least some light emitted by the LED that has not passed through the layer of phosphor material, onto the layer of phosphor material", explained in detail above. This feature is nowhere to be found in either Lowery or Takahashi, thus a rejection based on these references cannot be sustained. The rejection of claim 11 should be reversed.

Claim 12

Claim 12 depends directly from claim 2 and further specifies that the layer of phosphor material is co-planar with the LED. This additional feature cannot be found in either Lowery or Takahashi. The final Office Action states somewhat ambiguously that "Lowery modified by Takahashi would disclose the layer of phosphor material 80 is co-planar with the LED 50 (fig. 3)". Neither FIG. 3 of Lowery nor FIG. 3 of Takahashi teach or suggest a layer of phosphor material co-planar with an LED. In FIG. 3 of Lowery, LED 18 lies below the plane of layer 52. In FIG. 3 of Takahashi, no light source is depicted, much less one that is co-planar with phosphor layer 80. Item 50 in Takahashi's FIG. 3 is not an LED, but an "optical element" containing a light shielding film 52, polarizing plates 53, 59, cell walls 54, 58, address lines 55, and liquid crystal layer 56. See col. 9 lines 20-44. Since neither reference teaches or suggests a layer of phosphor material co-planar with an LED, the obviousness rejection cannot be sustained and the rejection should be reversed.

The rejection should also be reversed because claim 12 includes the limitation from claim 2 of "an interference reflector positioned to reflect at least some light emitted by the LED that has not passed through the layer of phosphor material, onto the layer of phosphor material", explained in detail above. This feature is nowhere to be found in either Lowery or Takahashi.

Claims 14-19 and 21

Claim 14 depends directly from claim 2 and claims 15-19 depend directly or indirectly from claim 14. Claim 14 further specifies that the layer of phosphor material is a discontinuous layer of phosphor material. Although Takahashi discloses a phosphor layer 80 that includes individual phosphor dots (col. 5 lines 16-59), as explained above such a phosphor layer is discussed in connection with a color display apparatus. One of ordinary skill in the art would have no motivation or incentive to transfer these display-related features of Takahashi into the discrete LED devices of Lowery. The rejection of claim 14 should be reversed.

The rejection should also be reversed because claim 14 includes the limitation from claim 2 of "an interference reflector positioned to reflect at least some light emitted by the LED that has not passed through the layer of phosphor material, onto the layer of phosphor material", explained in detail above. This feature is nowhere to be found in either Lowery or Takahashi.

Claims 15-19 and 21 include all the limitations of claim 14, and are patentable for at least the same reasons.

4. Claim 20 is patentably nonobvious over Lowery in view of Steklenski.

Claim 20 depends directly from claim 2, and further specifies that the reflector comprises alternating layers of a first and second thermoplastic polymer wherein at least some of the layers are birefringent. The Examiner reasons in the final Office Action that Lowery and Steklenski et al. have substantially the same environment of phosphor layer having a reflector", and therefore it would have been obvious "to modify Lowery's device with the teaching of Steklenski et al. to provide a polymeric multi-layer reflector in order to provide a uniform reflection across visible wavelength." Appellants disagree that Lowery and Steklenski "have substantially the same environments". As was the case with Lowery and Takahashi, Lowery and Steklenski are directed to substantially different end-products: Lowery to a discrete semiconductor LED device (see col. 1 lines 1-8 of Lowery, and the figures), and Steklenski to a radiographic phosphor panel used in imaging from X-radiation (see col. 1 lines 1-14 of Steklenski, and the figures), which appears to

have nothing to do with LED light sources. In view of the very different subject matter of these references, Applicants submit that one of ordinary skill working in the field of LED light sources would have no motivation to consult Steklenski, and one of ordinary skill working in the field of radiographic phosphor panels would have no motivation to consult Lowery.

Although Steklenski describes certain polymeric multilayer interference reflectors, the only rationale given to modify Lowery with the teachings of Steklenski is "in order to provide a uniform reflection across visible wavelength". But Lowery, the primary reference, provides no indication that such a feature is desirable, or on the other hand that such a feature is lacking from its disclosed embodiments. Moreover, in connection with any obviousness rejection the references must be considered as a whole, without the benefit of impermissible hindsight afforded by the claimed invention. MPEP § 2141 (II). In that regard, Steklenski teaches that "not just any polymeric multi-layer reflector can be used in the practice of this invention", and that "an essential feature of the present invention is the use of polymeric multi-layer reflectors that reflect most light striking them at 'high incident angles' and transmit and absorb most light striking them at 'low incident angles'. (Col. 4 lines 40-54 of Steklenski.) The Examiner has provided no evidence that such a feature would be acceptable, much less beneficial, in the invention of Lowery. Instead, the Examiner has impermissibly used Applicants' disclosure as a blueprint for piecing together different aspects of the references to defeat patentability – the essence of the tempting but forbidden zone of hindsight reconstruction. *See* In re Dembiczak, 50 USPQ2d 1614, 1616-17 (Fed. Cir. 1999). The rejection of claim 20 should be reversed.

The rejection should also be reversed because claim 20 includes the limitation from claim 2 of "an interference reflector positioned to reflect at least some light emitted by the LED that has not passed through the layer of phosphor material, onto the layer of phosphor material", explained in detail above. This feature is nowhere to be found in either Lowery or Steklenski.

CONCLUSION

Appellants' claims 1-21 are patentable over the applied references. Appellants earnestly solicit a favorable decision from the Board on each of the issues presented.

Please charge any additional fees or credit any overpayment to Deposit Account No. 13-3723.

Respectfully submitted,

24 Mar 2006
Date

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Telephone No.: 651-736-3369

Office of Intellectual Property Counsel
3M Innovative Properties Company
Facsimile No.: 651-736-3833

CLAIMS APPENDIX

1. A light source, comprising:

an LED capable of emitting light;

a layer of phosphor material positioned to receive excitation light and emitting visible light when illuminated with the excitation light; and

interference reflector means for reflecting at least some light emitted by the LED that has not passed through the layer of phosphor material, onto the layer of phosphor material and transmitting at least some visible light emitted by the phosphor.

2. A light source, comprising:

a layer of phosphor material;

an LED capable of emitting light that excites the phosphor material; and

an interference reflector positioned to reflect at least some light emitted by the LED that has not passed through the layer of phosphor material, onto the layer of phosphor material.

3. The light source according to claim 1 or 2, wherein the layer of phosphor has a major surface from which light is emitted toward an output end of the light source, and wherein the light emitted by the LED that has not passed through the layer of phosphor material is reflected onto the major surface of the layer of phosphor material.

4. The light source according to claim 2, wherein the reflector substantially reflects light emitted by the LED and substantially transmits light emitted by the phosphor material.

5. The light source according to claim 2, wherein the reflector has a planar shape.

6. The light source according to claim 2, wherein the reflector has a non-planar shape.

7. The light source according to claim 6, wherein the non-planar shape is substantially an ellipsoid, and wherein the LED and the layer of phosphor material are disposed at foci of the ellipsoid.

8. The light source according to claim 2, wherein a first portion of the light emitted by the LED is reflected by the reflector onto a major surface of the layer of phosphor material, and a second portion of the light emitted by the LED impinges on a second major surface of the layer of phosphor material opposed to the first major surface.

9. The light source according to claim 2, wherein the reflector has the shape of a surface of revolution.

10. The light source according to claim 2, wherein the layer of phosphor material surrounds the LED.

11. The light source according to claim 2, wherein the layer of phosphor material is segmented into distinct color regions.

12. The light source according to claim 2, wherein the layer of phosphor material is co-planar with the LED.

13. The light source according to claim 2, wherein the layer of phosphor material is not co-planar with the LED.

14. The light source according to claim 2, wherein the layer of phosphor material is a discontinuous layer of phosphor material.

15. The light source according to claim 14, wherein the discontinuous layer of phosphor material is a plurality of lines of phosphor material or a pattern of phosphor material.

16. The light source according to claim 14, wherein the discontinuous layer of phosphor material comprises a plurality of dots of phosphor material.

17. The light source according to claim 16, wherein the plurality of dots of phosphor material each have an area of less than 10000 microns^2.

18. The light source according to claim 16, wherein the plurality of dots comprise phosphor material that emits more than one color when illuminated with the excitation light.

19. The light source according to claim 16, wherein the plurality of dots comprise phosphor material that emits red, green and blue light when illuminated with the excitation light.

20. The light source according to claim 2, wherein the reflector comprises alternating layers of a first and second thermoplastic polymer wherein at least some of the layers are birefringent.

21. The light source according to claim 18, wherein at least a first phosphor dot emits light at a first wavelength and a second phosphor dot emits light at a second wavelength different than the first wavelength.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.